

Northumbria Research Link

Citation: Robinson, Lisa, Stephens, Nicola, Wilson, Stella, Graham, Laura and Hackett, Kate (2020) Conceptualizing the key components of rehabilitation following major musculoskeletal trauma: A mixed methods service evaluation. *Journal of Evaluation in Clinical Practice*, 26 (5). pp. 1436-1447. ISSN 1356-1294

Published by: Wiley-Blackwell

URL: <https://doi.org/10.1111/jep.13331> <<https://doi.org/10.1111/jep.13331>>

This version was downloaded from Northumbria Research Link:
<http://nrl.northumbria.ac.uk/id/eprint/41700/>

Northumbria University has developed Northumbria Research Link (NRL) to enable users to access the University's research output. Copyright © and moral rights for items on NRL are retained by the individual author(s) and/or other copyright owners. Single copies of full items can be reproduced, displayed or performed, and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided the authors, title and full bibliographic details are given, as well as a hyperlink and/or URL to the original metadata page. The content must not be changed in any way. Full items must not be sold commercially in any format or medium without formal permission of the copyright holder. The full policy is available online: <http://nrl.northumbria.ac.uk/policies.html>

This document may differ from the final, published version of the research and has been made available online in accordance with publisher policies. To read and/or cite from the published version of the research, please visit the publisher's website (a subscription may be required.)

1 **Conceptualising the key components of rehabilitation following major musculoskeletal**
2 **trauma: a mixed methods service evaluation**

3

4 Lisa J Robinson¹, Nicola M Stephens¹, Stella Wilson¹, Laura Graham¹, Katie L Hackett^{1,2}

5

6 ¹The Newcastle upon Tyne Hospitals NHS Foundation Trust, Newcastle upon Tyne, UK

7 ²Northumbria University, Newcastle upon Tyne, UK

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26 **Corresponding author:** Lisa Robinson, Major Trauma Rehabilitation Service, The Newcastle upon
27 Tyne Hospitals NHS Foundation Trust, Royal Victoria Infirmary, Newcastle upon Tyne, NE1 4LP,
28 UK, Telephone number: 00 44 (0)191 2824266

29

30 **Running title: Concept mapping in major trauma rehabilitation**

31 **Conceptualising the key components of rehabilitation following major musculoskeletal**
32 **trauma: a mixed methods service evaluation**

33

34 **ABSTRACT**

35 **Rationale, aims and objectives:** The reorganisation of acute major trauma pathways in
36 England has increased survival following traumatic injury, resulting in an increased patient
37 population with diverse and complex needs requiring specialist rehabilitation. However,
38 national audit data indicates that only 5% of patients with traumatic injuries have access to
39 specialist rehabilitation, and there are limited guidelines or standards to inform the delivery of
40 rehabilitation interventions for individuals following major trauma. This group concept
41 mapping project aimed to identify the clinical service needs of individuals accessing our
42 major trauma rehabilitation service, prioritise these needs, determine whether each of these
43 needs is currently being met, and plan targeted service enhancements.

44 **Methods:** Participants contributed towards a statement generation exercise to identify the key
45 components of rehabilitation following major trauma, and individually sorted these
46 statements into themes. Each statement was rated based on importance and current success.
47 Multidimensional scaling and hierarchical cluster analysis were applied to the sorted data to
48 produce themed clusters of ideas within concept maps. Priority values were applied to these
49 maps to identify key areas for targeted service enhancement.

50 **Results:** Fifty-eight patients and healthcare professionals participated in the ideas generation
51 activity, 34 in the sorting and 49 in the rating activity. A 7-item cluster map was agreed upon,
52 containing the following named clusters: Communication and coordination; Emotional and
53 psychological wellbeing; Rehabilitation environment; Early rehabilitation; Structured therapy
54 input; Planning for home; and Long-term support. Areas for targeted service enhancement
55 included access to timely and adequate information provision, collaborative goal setting and
56 specialist pain management across the rehabilitation pathway.

57 **Conclusion:** The conceptual framework presented in this paper illustrates the importance of a
58 continuum of rehabilitation provision across the injury trajectory, and provides a platform to
59 track future service changes and facilitate the co-design of new rehabilitation interventions
60 for individuals following major trauma.

61

62

63 **Keywords:** major trauma, rehabilitation, group concept mapping, service evaluation

64 **INTRODUCTION**

65 Major trauma describes serious and often multiple injuries where there is a strong possibility
66 of death or disability. Estimates in 2010 put the number of major trauma cases in England at
67 20,000 per year¹. A further 28,000 individuals were not classified as major trauma, but
68 identified as having significant rehabilitation needs¹. These figures are predicted to rise
69 dramatically on a global scale by 2030 as a result of war, violence and road traffic collisions².
70 This increase in the major trauma population has important implications for future health
71 service design, resource allocation, research and practice development, since these patients
72 require both acute inpatient care and long-term specialist rehabilitation.

73 Traumatic injuries place a significant burden on health and social care resources. The annual
74 cost of NHS care in the first 12 months following major trauma has recently estimated at
75 £1.53 billion³. This figure does not take into account societal knock on effects such as
76 unemployment, reduced productivity, and loss of earnings, which place considerable
77 demands on the economy. Hospital-treated injuries result in substantial health-related work
78 absence, with 17% of Emergency Department attenders and 43% of individuals admitted to
79 hospital not having returned to work 4 months post-injury⁴. Injuries also account for 10% of
80 sick notes in the UK⁵ and 14% of benefits claimants⁶.

81 In 2012, England underwent an extensive reconfiguration of services managing acute major
82 trauma. A two-tiered trauma system was established consisting of 27 major trauma centres
83 and multiple supporting trauma units. There is now a substantial and growing international
84 body of evidence to support the relationship between adequately resourced trauma centres
85 operating in regionalised trauma systems and reduced mortality in severely injured patients⁷⁻⁹.
86 This has resulted in an increased population of patients with diverse and complex physical,
87 functional and psychosocial needs requiring specialist multidisciplinary rehabilitation.

88 Rehabilitation forms a critical component of the patient pathway following major trauma.
89 However, an absence of new formal provision when trauma networks were established means
90 that specialist rehabilitation services for individuals with traumatic injuries lack coordination,
91 with large variations in provision across different parts of the country¹⁰. This paper describes
92 a structured and systematic evaluation and planning project which maps the service needs of
93 individuals with traumatic musculoskeletal injuries accessing our specialist multidisciplinary
94 rehabilitation service. The focus of our evaluation was to identify which high-priority needs
95 were successfully being met by the service and which were not. The resulting conceptual
96 framework will assist in planning locally-relevant priorities for research and targeted service
97 enhancement based on the lived experience of patients with ~~traumatic injuries~~ complex
98 musculoskeletal injuries following major trauma and multidisciplinary healthcare
99 professionals.

100 **MATERIALS AND METHODS**

101 **Design**

102 We used group concept mapping (GCM) methodology¹¹ to evaluate the first 18 months of our
103 MTRS. Our specific objectives were to: identify the clinical service needs of individuals
104 accessing our major trauma rehabilitation service (MTRS); prioritise these needs; determine
105 whether each of these needs is currently being met; and plan targeted service enhancements.

106 GCM is a mixed-methods participatory approach which uses a combination of individual and
107 group processes (ideas generation, sorting, rating and interpretation) and multivariate
108 statistical analysis (multidimensional scaling and hierarchical cluster analysis) to produce a
109 series of concept maps¹¹. Concept maps are visual representations of how participants
110 conceptualise the relationship between ideas they have generated on a particular topic. GCM
111 has been used in a variety of healthcare settings to plan, evaluate and make improvements to

112 existing healthcare policies, interventions and services. These include public health¹²,
113 fatigue¹³, mental health¹⁴, rheumatology¹⁵, cancer care¹⁶ and vocational rehabilitation¹⁷.

114 **Setting**

115 Data collection took place at the Royal Victoria Infirmary Great North Trauma and
116 Emergency Centre, North East England over a 6 month period (March 2018 – August 2018).
117 The MTRS at the Royal Victoria Infirmary was established in November 2016 in response to
118 a local gap-analysis which aimed to examine current rehabilitation provision for patients
119 following major trauma across North East England and produce a set of recommendations to
120 support future service development and commissioning¹⁰. In contrast to other groups of
121 patients requiring specialist rehabilitation (such as those with traumatic brain and spinal cord
122 injury), the gap-analysis identified that patients with musculoskeletal trauma in our local area
123 were often rehabilitated in generalist facilities by uni-professional services, creating the
124 potential for prolonged rehabilitation and poorer functional outcomes. Operating through a
125 centralised hub-and-spoke arrangement, the MTRS now provides a range of clinical services
126 for individuals presenting with complex musculoskeletal injuries following major trauma,
127 and consists of a purpose-built 10-bedded inpatient rehabilitation unit, a coordinating
128 rehabilitation hub and specialist multi-disciplinary outpatient clinic.

129 During the first year (November 2016 – November 2017), 337 patients were admitted to the
130 ten-bedded inpatient unit for specialist rehabilitation (197 male; mean age 54 years, SD 20).
131 Approximately one third of patients (n=106) were over 65 years of age. The shortest length
132 of stay on the unit was 0 days and the longest length of stay was 43 days, with a mean of
133 eight days (SD 6.91).

134 **Participant groups**

135 We recruited participants from 2 stakeholder groups: individuals who had received inpatient
136 care on the ten-bedded rehabilitation unit and were being followed up in the specialist
137 multidisciplinary outpatient service, and their family members where appropriate; and
138 multidisciplinary healthcare professionals responsible for providing care to individuals within
139 both the ten-bedded rehabilitation unit and specialist outpatient clinic. Participants were
140 identified at two distinct parts of the GCM process: during the ideas generation phase; and
141 again during the sorting and rating activities.

142 Thirty consecutive patients were invited to take part in the ideas generation activity during
143 their usual outpatient clinic attendance. The activity was made available during six clinics
144 (March 2018 – April 2018) for patients to complete as a pen and paper activity and place in a
145 box in the waiting area.

146 All 22 members of the MTRS Therapy Team (one consultant allied health professional; two
147 major trauma rehabilitation leads; seven occupational therapists: five physiotherapists; two
148 clinical psychologists; one speech and language therapist; one dietitian; one social worker;
149 two rehabilitation assistants) were contacted by email and invited to participate in the ideas
150 generation activity via a secure web-link. Email invitations were also sent to three consultant
151 trauma and orthopaedic surgeons, one consultant in rehabilitation medicine, 25 staff nurses
152 and 15 support workers. Email invitations were sent out in April 2018. Participants were
153 given four weeks to complete the activity online. A single reminder email was sent one week
154 before the online ideas generation activity closed for analysis.

155 Eight weeks after the ideas generation activity closed, the same 66 multidisciplinary
156 healthcare professionals were contacted by email and invited to participate in the sorting and
157 rating activities. Twenty three consecutive patients attending the specialist multidisciplinary
158 outpatient clinic between June 2018 and August 2018 were also invited to take part in the

159 sorting and rating activities during their routine clinic attendance. Because the sorting task
160 can be time-consuming to complete, participants were able to take part in the rating activity
161 without having to complete the sorting task.

162 **Data collection and analysis**

163 GCM typically involves five distinct stages: ideas generation; statement reduction; sorting;
164 rating; and data analysis. These stages are described sequentially below.

165 *Stage 1: ideas generation*

166 Participants were invited to respond to a focus prompt, an incomplete sentence they could
167 complete as many times as they wished. The precise wording of the focus prompt aimed to
168 identify the clinical service needs of individuals accessing the MTRS. The focus prompt was:
169 “*A specific way the rehabilitation service really makes a difference to people following major*
170 *trauma is*”

171 This process generated a list of statements from all participants taking part in this stage of the
172 project. The ideas generation activity was performed independently by participants. However,
173 the healthcare professionals completing the task online could see the statements provided by
174 those who had completed the activity previously. The patient responses were not added to the
175 online interface until after the ideas generation activity had closed for analysis. Consequently,
176 the healthcare professionals did not have access to the statements generated by patients
177 during this initial stage of data collection.

178 The authors (LR and KH) had access to statements generated by patients and healthcare
179 professionals throughout the data collection process. Interim analysis of these statements
180 meant that the ideas generation activity could be continued until data saturation¹⁸ was

181 achieved within each participant group. At this point, no new ideas were generated through
182 the qualitative responses received¹⁹.

183 ***Stage 2: statement reduction***

184 To create a manageable group of items representative of the ideas generated in Stage 1, the
185 full list of statements was reduced to a shorter list of unique ideas by LR and KH. First, we
186 split statements containing more than one idea into separate statements. Next, we applied a
187 keyword to each statement, formed groups of statements containing the same keyword, and
188 considered them in turn. Duplicate statements were removed and those describing the same or
189 overlapping ideas combined¹⁸. The refined statement list was reviewed for syntax and
190 readability by the full project team.

191 ***Stage 3: sorting activity***

192 Each statement was randomly allocated a number between one and 65 within the software
193 used for this GCM project (CS Global MAXTM). The numbered statements were printed onto
194 individual cards and participants were asked to sort them by creating piles of statements with
195 similar meanings ‘in a way that makes sense to you’. Participants received the following
196 guidelines for the sorting task: all items could not be put in a single pile; all items could not
197 be put into their own separate piles; items could not be placed in two piles simultaneously;
198 and there could not be any ‘miscellaneous’ piles. On completion of the sorting activity,
199 participants were asked to name each pile and document these on a recording sheet with the
200 corresponding statement numbers.

201 ***Stage 4: rating activity***

202 Participants were given a list of numbered statements and asked to rate each statement on a
203 five point Likert scale in relation to: perceived importance; and current success (1 = relatively

204 unimportant / need not being met at all; 5 = extremely important / need is successfully being
205 met).

206 *Stage 5: data analysis*

207 Analysis of the sorting and rating data was performed via the CS Global MAX™ web-based
208 platform specifically designed for GCM projects.

209 Multidimensional scaling was used to generate a point map depicting each of the numbered
210 statements and the relationships between them based on a summed square similarity matrix²⁰.

211 Statements frequently sorted together were placed closer together on the point map, as
212 participants considered them to be conceptually similar during the sorting activity.

213 Hierarchical cluster analysis was used to partition the point map into non-overlapping
214 clusters¹⁹. The CS Global MAX™ platform combined clusters one at a time and the
215 statements within each cluster were examined to ensure they conveyed the overall theme.

216 This data reduction technique continued until it no longer made sense to proceed to the next
217 iteration as the contents of the cluster were considered conceptually too broad. Maps
218 containing as many as 20 clusters and as few as four clusters were considered during an
219 initial interpretation session by LR and KH¹⁸. A provisional cluster solution was decided
220 upon through discussion and subsequently agreed upon by the full project team. The software
221 suggested labels for each cluster based on the names participants give to their piles during the
222 sorting exercise and final cluster names were selected based on these suggestions.

223 Model fit was assessed using the stress value, an indication of goodness of fit between the
224 point map the total similarity matrix. The acceptable range for GCM projects is between
225 0.205 and 0.365²⁰.

226 Importance and current success ratings were examined at a cluster level (pattern matches) and
227 individual statement level (go-zones). The pattern match evaluated the mean importance and
228 mean current success for each of the themed clusters. Go-zones are bi-variate value plots of
229 the importance and current success ratings that are divided into quadrants based upon the
230 mean values of those dimensions¹⁵. Statements that fall in the top-right quadrant of the go-
231 zone are above the mean for importance and current success (high importance, high success),
232 whereas statements that fall in the bottom-right quadrant are above the mean for importance
233 but below the mean for current success (high importance, low success). The pattern matches
234 and go-zones were used to prioritise the data into areas for targeted service enhancement.

235 **Ethical approval**

236 The project was reviewed by the Newcastle upon Tyne Hospitals NHS Foundation Trust
237 Research and Development Department and considered to be service evaluation, meaning no
238 Research Ethics Committee permissions were required. Approval was obtained from the
239 Trust Information Governance Department prior to commencing data collection.

240 **RESULTS**

241 **Participant characteristics**

242 Twenty-eight patients and 30 healthcare professionals took part in the ideas generation
243 activity. Twenty six healthcare professionals completed the sorting and rating activities.
244 Twenty-three patients took part in the rating activity, of which eight also completed the
245 sorting activity. To reduce the burden on the participants' time, different patients were
246 approached to take part in the ideas generation and sorting / rating activities. However,
247 because recruitment coincided with routine clinic appointments, four patients attending the

248 multidisciplinary outpatient service participated in both the ideas generation and sorting /
249 rating activities at different time points throughout the data collection process.

250 Forty-seven patients took part in at least one of the data collection stages, of which 28 were
251 male. The mean age was 52.57 (SD 17.10). In keeping with our clinical service specification,
252 individuals presented with a range of complex musculoskeletal injuries following major
253 trauma. Specific injury classifications were as follows: 27 multiple fractures; seven fractured
254 hips under 65 years; five single open fractures; four chest traumas; two pelvic fractures; two
255 spinal fractures, with no neurological involvement. We do not have demographic information
256 for the healthcare professionals as the ideas generation, sorting and rating activities were
257 undertaken anonymously.

258 **Statements from stages 1 and 2 and concept maps generated from stages 3, 4 and 5**

259 A total of 204 statements were produced by 58 participants during the ideas generation stage.
260 These were distilled to a final set of 65 unique statements for the sorting and rating activities.
261 Multidimensional scaling resulted in a point map with a stress value of 0.3134. A seven-item
262 cluster map was agreed upon for the combined sample (patients and healthcare
263 professionals), which contained the following named clusters: Communication and
264 coordination; Emotional and psychological wellbeing; Rehabilitation environment; Early
265 rehabilitation; Structured therapy input; Planning for home; and Long-term support. The
266 smallest cluster (Early rehabilitation) contained 6 statements, and the largest cluster
267 (Emotional and psychological wellbeing) contained 14 statements.

268 The point cluster map is shown in Figure 1. Here, each statement is represented by a
269 numbered point on the map. The points are grouped into the named clusters listed above. The
270 seven clusters identified by this GCM project, together with their location on the point cluster
271 map, illustrate participants' conceptualisation of a continuum of specialist rehabilitation

272 provision across the recovery pathway, from early rehabilitation in an inpatient setting to
273 longer-term support in the community following hospital discharge.

274 The pattern match depicted in Figure 2 compares mean importance and success ratings for
275 each of the seven clusters for all participants. Similarly ranked clusters for perceived
276 importance (left) and feasibility (right) are depicted with horizontal lines. When healthcare
277 professionals' and patients' mean scores were considered collectively, one cluster in
278 particular (Planning for home) indicated discordant results (illustrated by an oblique line),
279 being ranked highest for importance but only sixth-out-of-the-seven clusters for current
280 success. Early rehabilitation was considered a high priority area in which patient's needs
281 were being successfully met (ranked highest for current success and second for overall
282 importance). The lowest ranked cluster for both importance and current success was
283 Communication and Coordination. However, the oblique line indicates that participants
284 perceived the importance of this cluster to be greater than current success. The correlation
285 between mean importance and mean current success for all participants was moderate at 0.49.

286 The pattern match in Figure 3 compares the mean importance and mean success ratings for
287 patients (left) and healthcare professionals (right). The overall correlation for mean
288 importance ratings by healthcare professionals and patients was relatively high at 0.85. The
289 high levels of agreement in mean importance ratings are illustrated by the relatively
290 horizontal lines, with only minor differences in the ranked order of importance by the patients
291 and healthcare professionals. In contrast, the mean perceived success ratings of patients and
292 healthcare professionals showed high levels of discordance, with oblique lines for Long-term
293 support (ranked second by patients, but only fourth by healthcare professionals) and Planning
294 for home (ranked fourth by patients, and sixth by healthcare professionals). Although rankings
295 were similar between both groups for Structured therapy input (ranked fifth by patients and
296 healthcare professionals) and Communication and coordination (ranked seventh by patients

297 and healthcare professionals), the oblique lines indicate that patients rated the current success
298 of these two clusters more highly than healthcare professionals. The overall correlation for
299 current success ratings between patients and healthcare professionals was 0.71.

300 Go-zones were generated for each of the seven clusters (Figure 4). The zones of particular
301 interest for this project were high importance / high current success (priority needs that are
302 being successfully met) and high priority / lower current success (priority areas for targeted
303 service enhancement). These are represented by the upper-right and lower-right quadrants of
304 the go-zone graphs respectively. Table 1 provides an overview of the individual statements
305 contained within each of the seven themed clusters. We have highlighted the areas of current
306 service provision perceived collectively by our participants to be of both high importance /
307 high current success (upper right quadrant of each go-zone) and high priority / lower current
308 success (lower right quadrant of each go-zone).

309 **DISCUSSION**

310 This project engaged a heterogeneous group of patients presenting with a variety of
311 musculoskeletal injuries following major trauma and healthcare professionals in a structured
312 and systematic GCM project to evaluate the first 18 months of a new specialist
313 multidisciplinary rehabilitation service. The cluster maps presented in this paper depict where
314 the MTRS successfully addresses issues which matter to patients with complex
315 musculoskeletal trauma and healthcare practitioners as well as identifying key areas for
316 targeted service enhancement.

317 This GCM project was conducted with participants from a single major trauma centre in the
318 North East of England. Consequently, the findings may not be generalisable to the wider
319 trauma population. Nevertheless, the findings from this GCM project represent a multi-
320 stakeholder conceptualisation of successful rehabilitation provision following major

321 musculoskeletal trauma which has not previously existed in the literature. In this section, we
322 provide an overview of our key findings within the context of the wider rehabilitation
323 literature to enable organisations to establish transferability of principles for their own patient
324 populations and models of clinical service delivery.

325 A substantial and emerging body of evidence exists to indicate that adequately-resourced
326 major trauma centres, operating within regionalised trauma systems, increase survival for
327 severely injured patients⁹. Despite such advancements, national audit data indicates that only
328 5% of NHS patients with traumatic injuries currently have access to specialist
329 rehabilitation²¹, and there are limited guidelines or standards to inform the delivery of
330 rehabilitation interventions for individuals following major trauma. Qualitative research from
331 our team has previously described the patient experience following major trauma as a journey
332 through repair and rehabilitation to achieve recovery²². The conceptual framework presented
333 in this paper would appear to support this injury trajectory and illustrates the importance of a
334 continuum of rehabilitation provision across the recovery pathway following major
335 musculoskeletal trauma, from early rehabilitation in an acute inpatient setting to long-term
336 support in the community following hospital discharge.

337 For many individuals and their family members, the psychological consequences of major
338 trauma can be complex and lifelong²³. The findings from this GCM project would indicate
339 that promoting emotional and psychological wellbeing following complex musculoskeletal
340 trauma extends far beyond #62 *access to specialist psychology input on the ward* (low
341 importance / high success) and #27 *access to specialist psychology as an outpatient* (low
342 importance / low success). Participants in our GCM project described an integrated approach
343 to clinical service delivery in which all staff members provided #5 *support to overcome the*
344 *mental stress of an incident as opposed to just focusing on physical injuries*. Patients with
345 traumatic musculoskeletal injuries valued and benefitted from #52 *the constant support and*

346 *encouragement provided during therapy sessions* as well as #30 *a positive outlook from staff*
347 *when patients feel quite depressed by their injuries*. It is our recommendation that healthcare
348 professionals from all disciplines must be skilled to provide emotional support to individuals
349 with traumatic injuries and receive the necessary education and training to identify patients
350 requiring formal psychological interventions for sustained symptoms of distress at every
351 stage of the rehabilitation pathway.

352 Goal-setting was identified as a core component of emotional and psychological wellbeing,
353 with #15 *encouraging patients to list their own goals* identified as an important area of
354 clinical practice that was being successfully met by the MTRS. In contrast, #53 *setting*
355 *challenging goals that help patients both physically and mentally when achieved* was
356 identified as an important area for targeted service enhancement. Therapy input in the early
357 stages of rehabilitation often needs to concentrate on getting patients ready for discharge as
358 soon as possible²⁴. Consequently, initial treatment goals tend to be formulated from a
359 professional perspective and focus on regaining independence in functional tasks, such as
360 transfers and basic self-care activities²⁴. In many cases, it is not until the patient returns home
361 that they are encouraged to set more ambitious and meaningful goals in keeping with their
362 pre-injury status and function²⁵. To improve engagement with therapy interventions
363 following major musculoskeletal trauma, healthcare professionals should be encouraged to
364 work collaboratively with individuals and their family members to set structured goals that
365 can be adapted to the patient's needs and definition of problems over time and across
366 rehabilitation settings.

367 This GCM project identified #36 *having pain relief readily available*, and #39 *having access*
368 *to the specialist pain team* as areas of high importance / low current success within the MTRS
369 (Rehabilitation environment cluster). Effective and timely pain management has been shown
370 to reduce the stress response following traumatic injury, promote early healing, shorten

371 hospital stay and reduce the risk of chronic pain²⁶. In many cases, however, pain hinders
372 rehabilitation and recovery²⁷, with up to 18% of the major trauma population going on to
373 develop problems with chronic pain post-injury²⁸. Guidelines from the National Institute of
374 Health and Care Excellence²⁹ and Royal College of Anaesthetists³⁰ recommend that patients
375 in a major trauma centre have access to specialist pain management services. However, these
376 guidelines tend to focus on the acute trauma post-trauma period, and offer little guidance in
377 relation to pain management during the rehabilitation phase of the recovery pathway.

378 The context in which a patient's injury occurred can have a profound effect on their
379 interpretation and experience of pain following major trauma³¹, and evidence would indicate
380 that an individual's psychological disposition may be used to accurately predict recovery and
381 the likelihood of chronic pain developing post-injury³². Traditional practice dictates that
382 individuals with traumatic injuries are managed within an acute biomedical care model.
383 However, these observations support the exploration of more psychologically-based pain
384 management strategies following major musculoskeletal trauma. The introduction of a
385 multidisciplinary transitional pain service³³ could also help to identify at-risk patients and
386 optimise pain management for individuals with traumatic musculoskeletal injuries, offering a
387 range of tailored and timely interventions across the hospital-to-home trajectory.

388 In GCM projects, the orientation of the clusters relative to the top or bottom of the map has
389 no particular meaning, but the location of the clusters relative to one another helps describe
390 their relationship¹². The Communication and coordination cluster is located centrally on our
391 point cluster map, indicating a conceptual link between this cluster and the surrounding
392 clusters. Statements relating to communication and coordination were identified in five of the
393 seven clusters, highlighting the importance of this conceptual theme across all phases of the
394 rehabilitation pathway. Participants valued #60 *the ability to ask questions throughout the*
395 *recovery process* (Planning for home cluster) as well as #37 *being listened to at every*

396 *appointment and receiving answers to all questions* (Long-term support cluster). There were
397 occasions, however, when patients and multidisciplinary healthcare professionals experienced
398 significant barriers to effective communication and information provision, with #25 *good*
399 *communication between doctors, therapists and nursing staff*, and #63 *the provision of*
400 *consistent information* (Planning for home cluster) identified as important areas for targeted
401 service enhancement.

402 In this GCM project, #33 *ensuring therapy sessions are coordinated with nursing activities*,
403 and #34 *ensuring a seamless transfer between acute wards, rehabilitation unit, home, and*
404 *after-care* were identified as key improvement targets (Structured therapy input cluster). In
405 contrast, #31 *having a keyworker assigned to help make sense of the information coming*
406 *from different doctors and consultants*, and #40 *keyworkers ensuring that their patients are*
407 *comfortable and can ask questions without fear* (Communication and co-ordination cluster),
408 together with #8 *having a keyworker to contact on the ward and longer-term* (Long-term
409 support cluster) were highlighted as important areas of good practice. An enhanced
410 understanding of the types of information needed and the most appropriate communication
411 strategies for sharing this information may assist healthcare professionals to work more
412 effectively with patients with traumatic musculoskeletal injuries and their family members³⁴.
413 With the appropriate level of training and resources, the findings from this GCM project
414 would indicate that multidisciplinary healthcare professionals working in defined keyworker
415 roles are well-positioned to provide anticipatory information and guidance to collaboratively
416 address patient goals across the rehabilitation pathway.

417 **Strengths, limitations and recommendations**

418 Fifty eight participants (28 patients and 30 healthcare professionals) took part in the ideas
419 generation activity, 49 participants (23 patients and 26 healthcare professionals) completed

420 the rating activity and 34 (eight patients and 26 healthcare professionals) the sorting task.
421 Despite being an exploratory single centre service evaluation, our sample size is within the
422 acceptable range for GCM projects¹⁸. A pooled analysis of 69 GCM studies undertaken by
423 Rosas and Kane reported samples sizes between 20 and 649 following the introduction of a
424 web-based platform for the concept mapping procedure²⁰.

425 We elected to recruit individuals from our multidisciplinary out-patient clinic to ensure
426 participants had experienced the full continuum of rehabilitation provision available in our
427 local region. Although the mean age of patients participating in this GCM project was
428 comparable to the mean age of the wider trauma population accessing our MTRS (52.57
429 years, SD 17.10 and 54 years, SD 20 respectively), it is acknowledged that the recruitment of
430 consecutive patients had the potential to miss important participant characteristics, and that
431 this could have impacted on the results obtained. Participants presented with a wide range of
432 musculoskeletal injuries following major trauma and were at least 8 weeks post-hospital
433 discharge. However, the use of a sampling framework would have enabled us to purposively
434 sample individuals with a range of pre-determined participant characteristics, minimising the
435 risk of under-representation of important sub-groups of patients³⁵.

436 Every effort was made to invite and include healthcare professionals from a broad range of
437 disciplines. However, guidance from our Trust's Information Governance Department
438 required online data to be collected anonymously. Consequently, we are not able to report the
439 demographic information of the healthcare professionals choosing to participate in the ideas
440 generation, sorting and rating activities. With a response rate of 45% (ideas generation) and
441 39% (sorting and rating), we cannot rule out the possibility of selection bias and it is possible
442 that certain staff groups may have been poorly represented during the data collection process.
443 Despite these potential limitations, our GCM project compares favourably with Rosas and
444 Kane's pooled analysis where participation rates averaged 20-30% across the sample²⁰.

445 Future GCM work with senior managers, commissioners, community rehabilitation teams
446 and social services colleagues may help to further refine and develop the cluster maps
447 presented in this paper.

448 The sorting task can be a time consuming activity. The recommended number of participants
449 required for the sorting activity is 25²⁰. Although 34 participants took part in the sorting
450 activity within our GCM project, only eight of these were patients of the MTRS. This could
451 have biased the organisation and orientation of the final clusters. However, the sorting
452 activity is largely dependent on the statements provided during the ideas generation activity
453 of which there was almost equal representation from patients and healthcare professionals.
454 Forty seven patients with a wide diversity in age and injury classification participated in at
455 least one of the data collection stages, with 23 patients rating the statements obtained from
456 the ideas generation activity. It is acknowledged that the rating data specifically pertains to
457 the clinical service under evaluation. Researchers and rehabilitation specialists are
458 encouraged to consider the utility of the results to improve the quality of care in their
459 organisations. Those lacking the necessary time or resources to complete their own GCM
460 project may wish to undertake their own rating exercise using the 65 statements presented in
461 this paper to identify key areas for targeted service enhancement.

462 **CONCLUSION**

463 We have identified and organised the service needs of a heterogeneous group of patients **with**
464 a variety of complex musculoskeletal injuries following major trauma and multidisciplinary
465 healthcare professionals. Despite being relatively early in its conceptualisation and
466 implementation, the findings from this GCM project would indicate that the MTRS is
467 successfully addressing a large number of areas deemed important by patients and healthcare
468 professionals. The conceptual framework presented in this paper illustrates the importance of

469 a continuum of rehabilitation provision across the recovery pathway, from early rehabilitation
470 in an acute inpatient setting to longer-term support in the community following hospital
471 discharge. GCM provided a structured and systematic approach for identifying specific areas
472 for targeted service enhancement across the recovery pathway, and could be used as a useful
473 benchmark from which to track future service changes and facilitate the co-design of new
474 rehabilitation interventions for individuals following major musculoskeletal trauma.

References

1. National Audit Office. Major trauma care in England. London: the Stationery Office; 2010
2. World Health Organization Department of Violence, Injury Prevention and Disability. Violence, injuries and disabilities: biennial report 2010-2011. Geneva: WHO; 2012
3. Kellezi B, Baines DL, Coupland C, Beckett K, Barnes J, Sleney J, et al. The impact of injuries on health service resource use and costs in primary and secondary care in the English NHS. *J Public Health* 2015; 38: e464-e471
4. Kendrick D, Vinogradova Y, Coupland C, Christie N, Lyons RA, Towner E, et al. Getting back to work after injury: the UK Burden of Injury multicentre longitudinal study. *BMC Public Health* 2012; 12: 584
5. Black C. *Working for a healthier tomorrow. Dame Carol Black's review of the health of Britain's working age population.* London: TSO; 2008
6. Black C and Frost D. *Health at work: an independent review of sickness absence.* London: TSO; 2011
7. Dinh M, Bein K, Gabbe B, Byrne C, Petchell J, Lo S, et al. A trauma quality improvement project associated with improved patient outcomes: 21 years of experience at an Australian Major Trauma Centre. *Injury* 2014; 45: 830-834
8. Truchon C, Moore L, Belcaid A, Clement J, Trudelle N, Ulysse MA et al. Dhaping quality through vision, structure and monitoring of performance and quality indicators: impact story from the Quebec Trauma Network. *International Journal of Technology Assessment in Healthcare* 2017; 33: 1-5
9. Moran CG, Lecky F, Bouamra O, Lawrence T, Edwards A, Woodford M, et al. Changing the system – major trauma patients and their outcomes in the NHS (England) 2008-17. *E Clinical Medicine* 2018; 2-3: 13-21
10. Irwin J and Carter A. Major trauma patients with musculoskeletal injuries: rehabilitation pathway inadequacies. *Int J Ther Rehabil* 2013; 20: 376-377
11. Trochim W. An introduction to concept mapping for planning and evaluation. *Eval Program Plann* 1989; 12: 1-16
12. Anderson LA, Slonim A, Yen IH, Jones DL, Allen P, Hunter RH, et al. Developing a framework and priorities to promote mobility among older adults. *Health Educ Behav* 2014; 41: 10S-18S
13. Hackett KL, Lambson RL, Strassheim V, Gotts Z, Deary V and Newton JL. A concept mapping study evaluating the UK's first NHS generic fatigue clinic. *Health Expect* 2016; 19: 1138-1149

14. van Grieken RA, Kirkenier ACE, Koeter MWJ, Nabitz UW and Schene AH. Patients' perspectives on self-management in the recovery from depression. *Health Expect* 2013; 18: 1339-1348
15. Hackett KL, Dean KHO, Newton JL, Deary V, Bowman SJ, Rapley T, et al. Mixed-methods study identifying key intervention targets to improve participation in daily living activities in Primary Sjorgren's Syndrome Patients. *Arthritis Care Res* 2018; 70: 1064-1073
16. McFall SL, Mullen PD, Byrd TL, Cantor S B, Le YC, Torres-Vigil I, et al. Treatment decisions for localized prostate cancer: a concept mapping approach. *Health Expect* 2014; 18: 2079-2090
17. Leyshon R and Shaw L. Using multiple stakeholders to define a successful return to work: a concept mapping approach. *Work* 2012; 41: 397-408
18. Kane M and Trochim WM. *Concept mapping for planning and evaluation*. London: Sage; 2007
19. De Kok M, Scholte RW, Sixma HJ, van der Weijden T, Spijkers KF, van der Velde CJH, et al. The patient's perspective of the quality of breast cancer care: the development of an instrument to measure quality of care through focus groups and concept mapping
20. Rosas SR and Kane M. Quality and rigor of the concept mapping methodology: a pooled study analysis. *Eval Program Plann* 2012; 35: 236-245
21. Turner-Stokes L. *First report of the National Clinical Audit of Specialist Rehabilitation following Major Injury*. London: NCASRI Project Team; 2016
22. Claydon JH, Robinson L, Aldridge SE. Patients' perceptions of repair, rehabilitation and recovery after major orthopaedic trauma: a qualitative study. *Physiotherapy* 2017; 103: 322-329
23. Harms L and Talbot M. The aftermath of road trauma: survivors' perceptions of trauma and growth. *Health Soc Work* 2007; 32:129-137
24. van Seben R, Smorenburg SM, Buurman BM. A qualitative study of patient-centred goal-setting in geriatric rehabilitation: patient and professional perspectives. *Clinical Rehabil* 2018; 33: 128-140
25. Kessler D, Walker I, Sauve-Schenk K and Egan M. Goal setting dynamics that facilitate or impede a client-centred approach. *Scand J Occup Ther* 2018; DOI: 10.1080/11038128.2018.1465119 (Epub ahead of print)
26. Ahmadi A, Bazargan-Hejazi S, Zadi ZH, Euasobhon P, Ketumarn P, Karbasfrushan A, et al. Pain management in trauma: a review study. *J Inj Violence Res* 2016; 8: 89-98

27. Archer KR, Abraham CM, Obremskey WT. Psychosocial factors predict pain and physical health after lower extremity trauma. *Clin Orthop Relat Res* 2015; 473: 3519-3526
28. Breivek H, Collett B, Ventafidda V, Cohen R, Gallacher D. Survey of chronic pain in Europe; prevalence, impact on daily life and treatment. *Eur J Pain* 2006; 10: 287-333
29. National Institute for Health and Care Excellence. *Major trauma: assessment and initial management*. London: NICE; 2016
30. Royal College of Anaesthetists. *Core standards for pain management services in the UK*. London: RCA; 2015
31. Watkinson P, Wood AM, Lloyd DM, and Brown GDA. Pain ratings reflect cognitive context; a range frequency model of pain perception. *Pain* 2013; 154: 742-749
32. Vincent HK, Horodyski M, Vincent KR, Brisbane ST, Sadasivan KK. Psychological distress after orthopaedic trauma: prevalence in patients and implications for rehabilitation. *PM&R* 2015; 7: 978-989
33. Huang A, Katz J, Clark H. Ensuring safe prescribing of controlled substances for pain following surgery by developing a transitional pain service. *Pain Manag* 2015; 5: 97-105
34. Friedman-Sanchez G, Griffin JM, Rettmann NA, Rittman M and Partin MR. Communicating information to families of polytrauma patients: a narrative literature review. *Rehabil Nurs* 2008; 33: 206-213
35. Onwuegbuzie AJ and Leech NL. Sampling designs in qualitative research: making the sampling process more public. *The Qualitative Report* 2007; 12 (2): 238-254

Acknowledgements

The authors would like to thank the patients and healthcare professionals who participated in this group concept mapping project.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship and / or publication of this article.

Funding

Funding was obtained from The Newcastle upon Tyne Hospitals NHS Foundation Trust to purchase a single project license from Concept Systems, Inc.

Table 1 – Mean importance and success ratings for each of the 65 statements

		Importance (1-5)	Current Success (1-5)
<i>Planning for home (7 statements)</i>		4.54	4.12
25 [†]	Good communication between doctors, therapists and nursing staff	4.93	3.68
60*	The ability to ask questions throughout the recovery process	4.74	4.55
63 [†]	The provision of consistent information	4.56	3.87
16	Staff in hospital providing a realistic view of what life will be like on discharge and advising accordingly	4.52	4.15
26	Receiving a detailed rehabilitation prescription on discharge	4.49	4.64
32	Discussing and reviewing goals regularly throughout the recovery process	4.40	4.15
10	Ensuring that relatives are kept informed of the patient's progress	4.11	3.79
<i>Early rehabilitation (6 statements)</i>		4.49	4.44
2 [†]	Having access to early intensive rehabilitation	4.70	4.43
43*	Receiving training in the use of mobility aids and tackling mobility issues, such as stairs	4.59	4.64
21*	Being given an individualised exercise programme to regain confidence and speed recovery	4.58	4.45
7	Being encouraged to get up and get moving straight away	4.41	4.40
46	Having access to structured therapy sessions	4.39	4.28
13	Coaching on simple tasks, such as kitchen activities and dressing	4.28	4.45
<i>Emotional and psychological wellbeing (14 statements)</i>		4.37	4.17
17*	Staff who are friendly and approachable	4.87	4.57
14*	Being treated with dignity, which is important in this most vulnerable of times	4.84	4.70
20	Focusing on the patient as an individual, with individual needs	4.64	4.55
5*	Support to overcome the mental stress of an incident as opposed to just focusing on physical injuries	4.61	4.38
30*	A positive outlook from staff when patients feel quite depressed by their injuries	4.51	4.51
22 [†]	Providing a confidential environment where patients can talk about their worries	4.42	4.06
15*	Encouraging patients to list their own goals	4.41	4.47

52*	The constant support and encouragement provided by therapy sessions	4.41	4.38
53 [†]	Setting challenging goals that help patients both physically and mentally when achieved	4.39	4.15
62	Access to specialist psychology on the ward	4.28	4.26
27	Access to specialist psychology as an outpatient	4.16	3.33
45	Support with getting back to work	4.16	3.51
51	Knowing you are not alone in a situation, other people have it the same or worse	4.02	4.04
19	Meeting other patients, families and carers in similar situations	3.38	3.52
<i>Rehabilitation environment (12 statements)</i>		4.32	4.30
59*	Input from skilled staff who have a wide range of expertise in trauma	4.65	4.47
36 [†]	Having pain relief readily available	4.62	4.22
48*	Being on a dedicated rehabilitation unit with more privacy and more focused support specific to the patient's injuries	4.57	4.68
39 [†]	Having access to a specialist pain team	4.56	4.09
64 [†]	A well laid out environment, which makes moving around easier	4.48	4.28
6*	Having a dedicated gym area, which a lot of acute wards don't have	4.37	4.68
28*	Having an accessible kitchen to promote independence	4.36	4.60
54	A relaxed atmosphere and surroundings to make patients feel more at home	4.24	4.43
61	The amount of time each professional gets to spend with the patient	4.22	4.15
29	Receiving seven day therapeutic input over a twelve hour period	4.00	4.09
42	Having a variety of groups and activities to engage patients in the rehabilitation process on a day-to-day basis	3.96	4.04
50	Group work to improve social integration and to receive support and encouragement from other patients	3.89	3.87
<i>Long-term support (10 statements)</i>		4.32	4.21
65*	Follow up appointments which help to identify areas of the patient's recovery that might not have been addressed otherwise	4.67	4.60
37*	Being listened to at every appointment and receiving answers to all questions	4.67	4.23
38*	Feeling as though the patient is still being looked after and that their progress continues to be monitored on discharge	4.64	4.34

1*	Being given a contact number on discharge for ongoing queries	4.48	4.81
57*	Staff understanding the patient's personal circumstances and how injuries and / or a traumatic experience can affect their lives	4.48	4.32
47*	A follow up phone call 2 weeks after discharge to see if the patient needs anything	4.46	4.46
8*	Having a keyworker to contact on the ward and longer term	4.39	3.39
12*	Ongoing support from a specialist multidisciplinary team on discharge	4.39	4.28
11	Therapy staff from the rehabilitation service attending fracture clinic appointments to provide additional advice and reassurance	3.67	2.89
3	Not providing too much information as this can sometimes cause anxiety	3.36	3.74
<i>Structured therapy input (7 statements)</i>		4.30	4.14
55*	The assessment of equipment needs prior to returning home	4.76	4.68
34 [†]	Ensuring a seamless transfer between acute wards, rehabilitation unit, home and aftercare	4.60	3.96
49*	The preparation done to support discharge home, including the possibility of home visits	4.57	4.38
33 [†]	Ensuring that therapy sessions are coordinated with nursing activities	4.33	3.57
58	Grading tasks to match confidence levels	4.09	4.11
35	Having an individualised timetable and knowing the plan for the next day	4.02	4.46
9	Receiving information about recovery techniques in a group setting	3.76	3.81
<i>Communication and coordination (9 statements)</i>		4.25	3.95
4*	Staff working as part of a team to ensure all the patient's needs are being met promptly	4.78	4.12
23 [†]	Medical input from a consultant in rehabilitation medicine	4.66	3.89
24 [†]	Receiving reassurance from doctors and consultants that some pain and discomfort is to be expected and that the patients injuries are healing normally	4.53	3.89
40*	Keyworkers ensuring that patients are comfortable and can ask questions without fear	4.43	4.28
41*	Staff taking the time to formulate and consider the patient's needs above and beyond the ward setting	4.33	4.11
31*	Having a key worker assigned to help make sense of the information coming from different doctors and consultant	4.31	4.14

44	Offering advocacy services to those who require them	4.02	3.66
18	Social work input for help with benefits	3.84	3.73
56	Not being asked to do therapy when visitors are present	3.30	3.64

Unique identification numbers in left hand column correspond to the numbers depicted in the point cluster map (Figure 1) and go-zone plots (Figure 4).

* High importance / high success (upper right quadrant of go-zone)

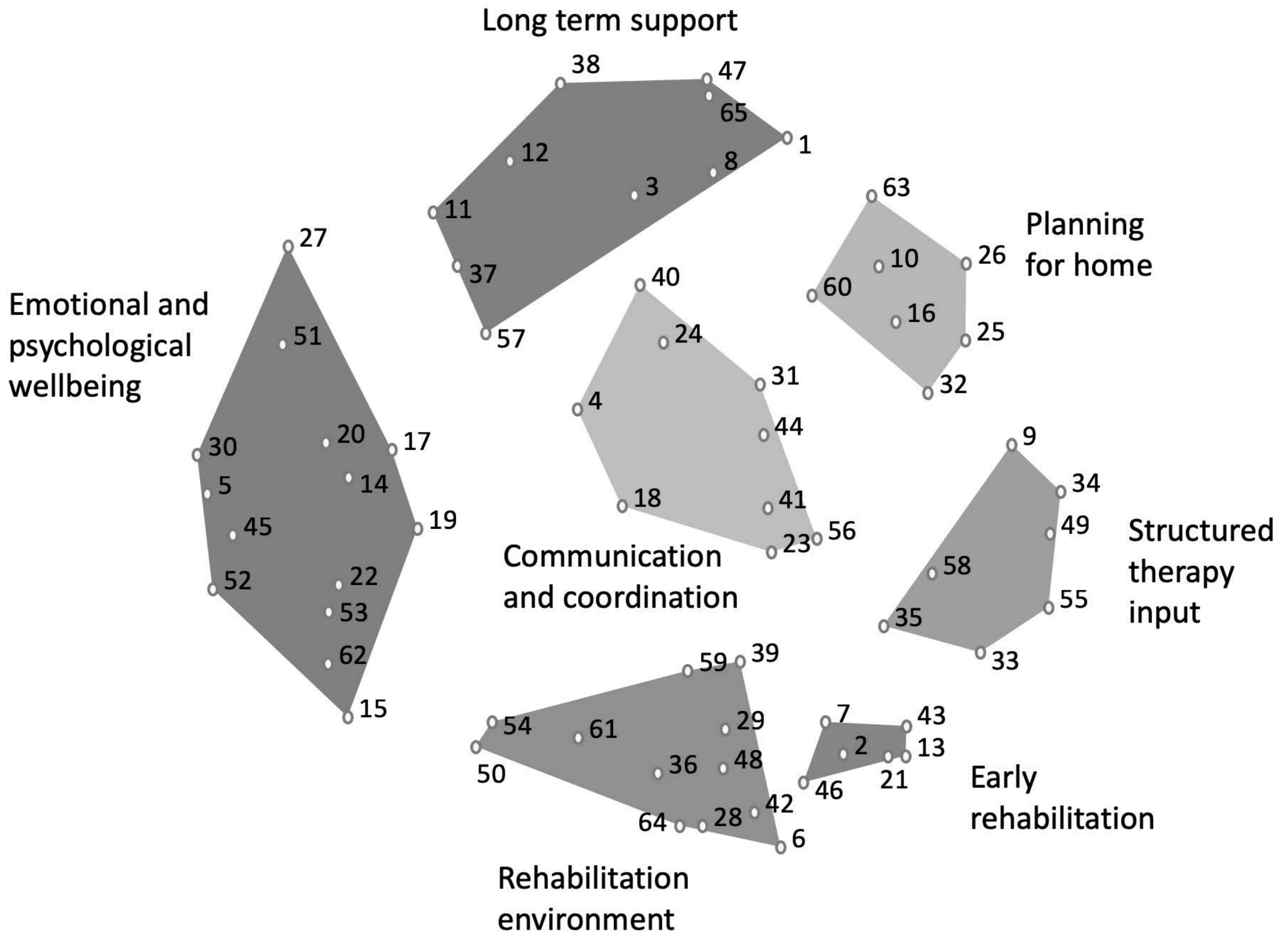
† High importance / low success (lower right quadrant of go-zone)

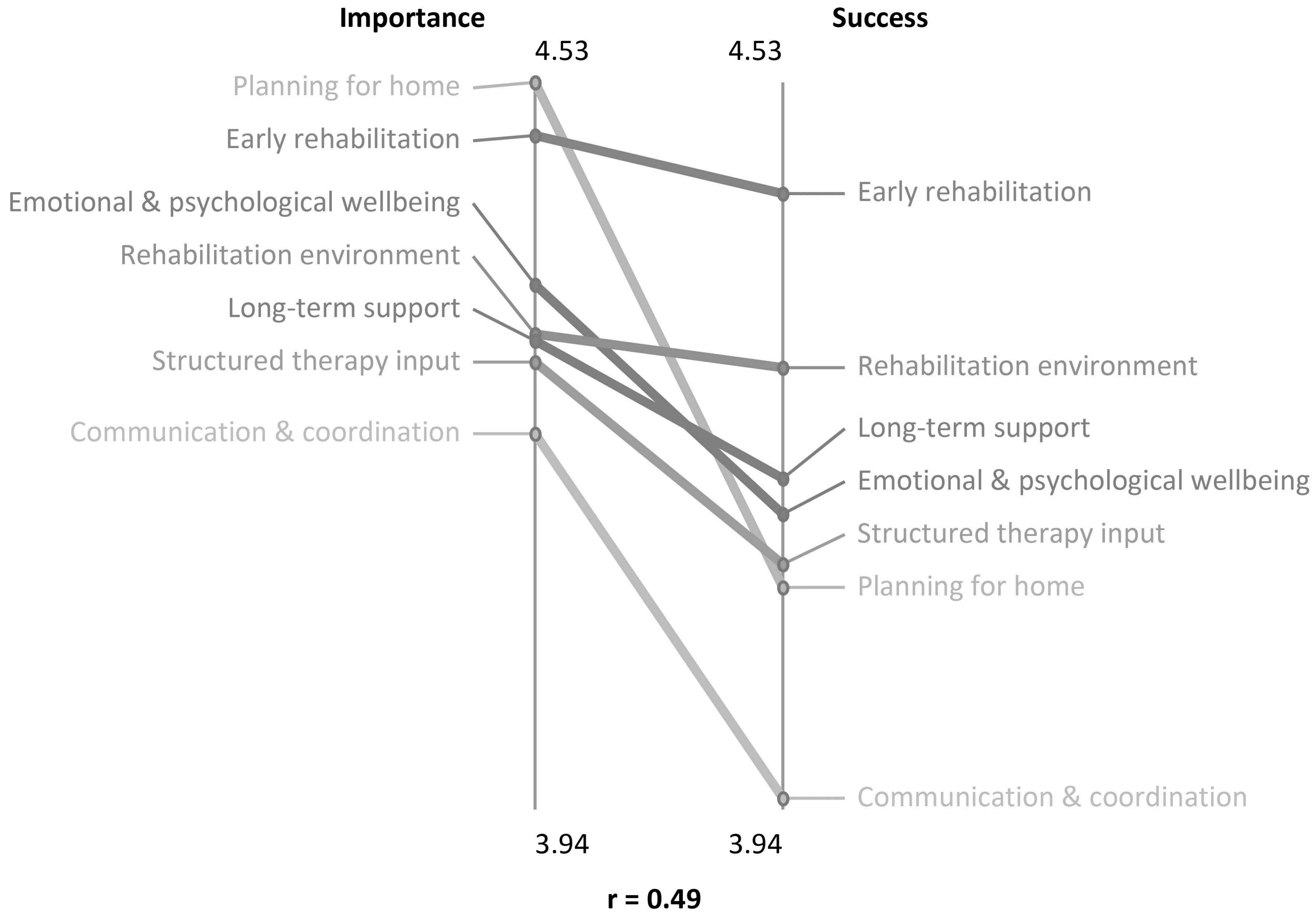
Figure 1 - Point cluster map

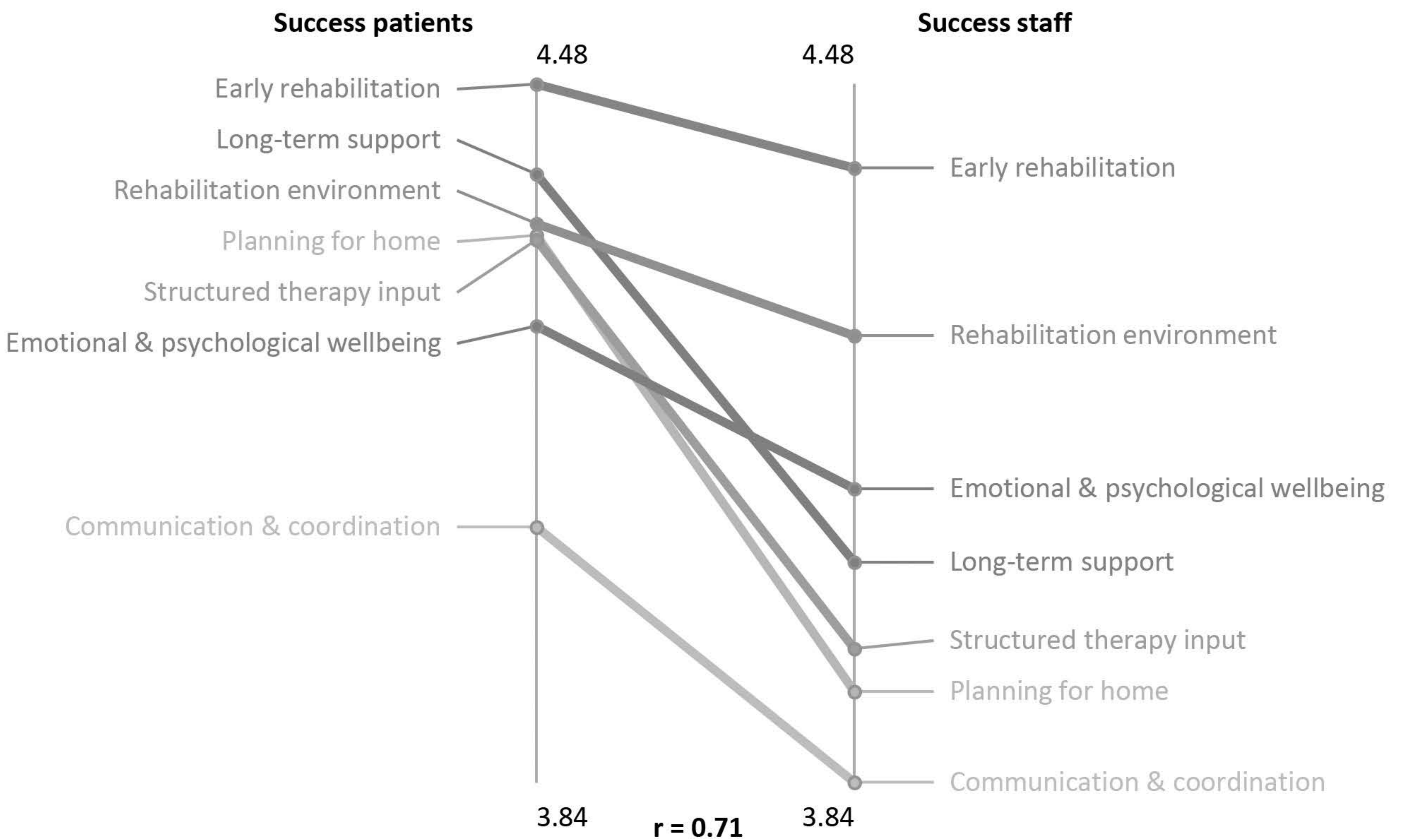
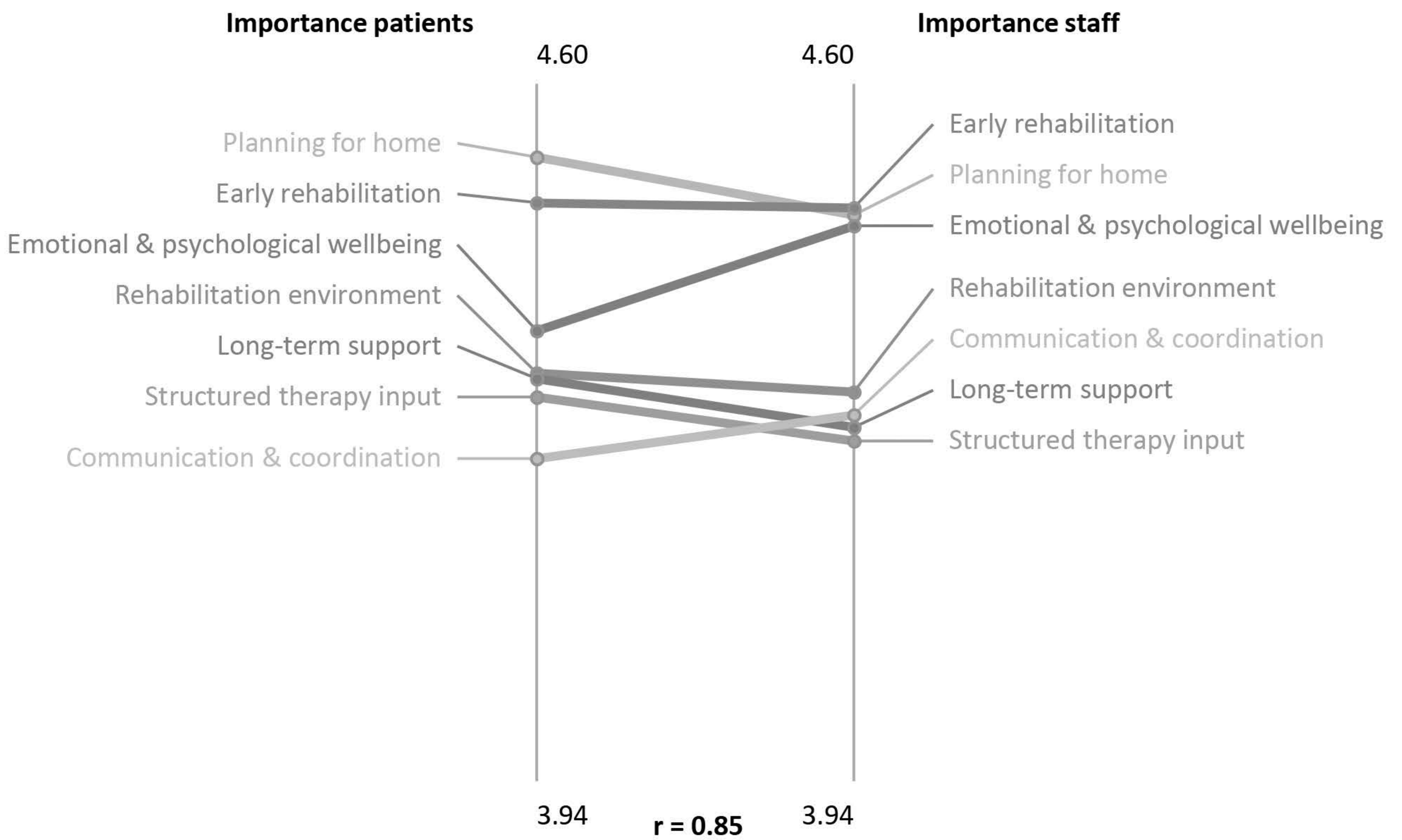
Figure 2 - Pattern match (Importance and success for all participants)

Figure 3 - Pattern match (Importance comparing patients and healthcare professionals and success comparing patients and healthcare professionals)

Figure 4 - Go zones for each of the seven clusters

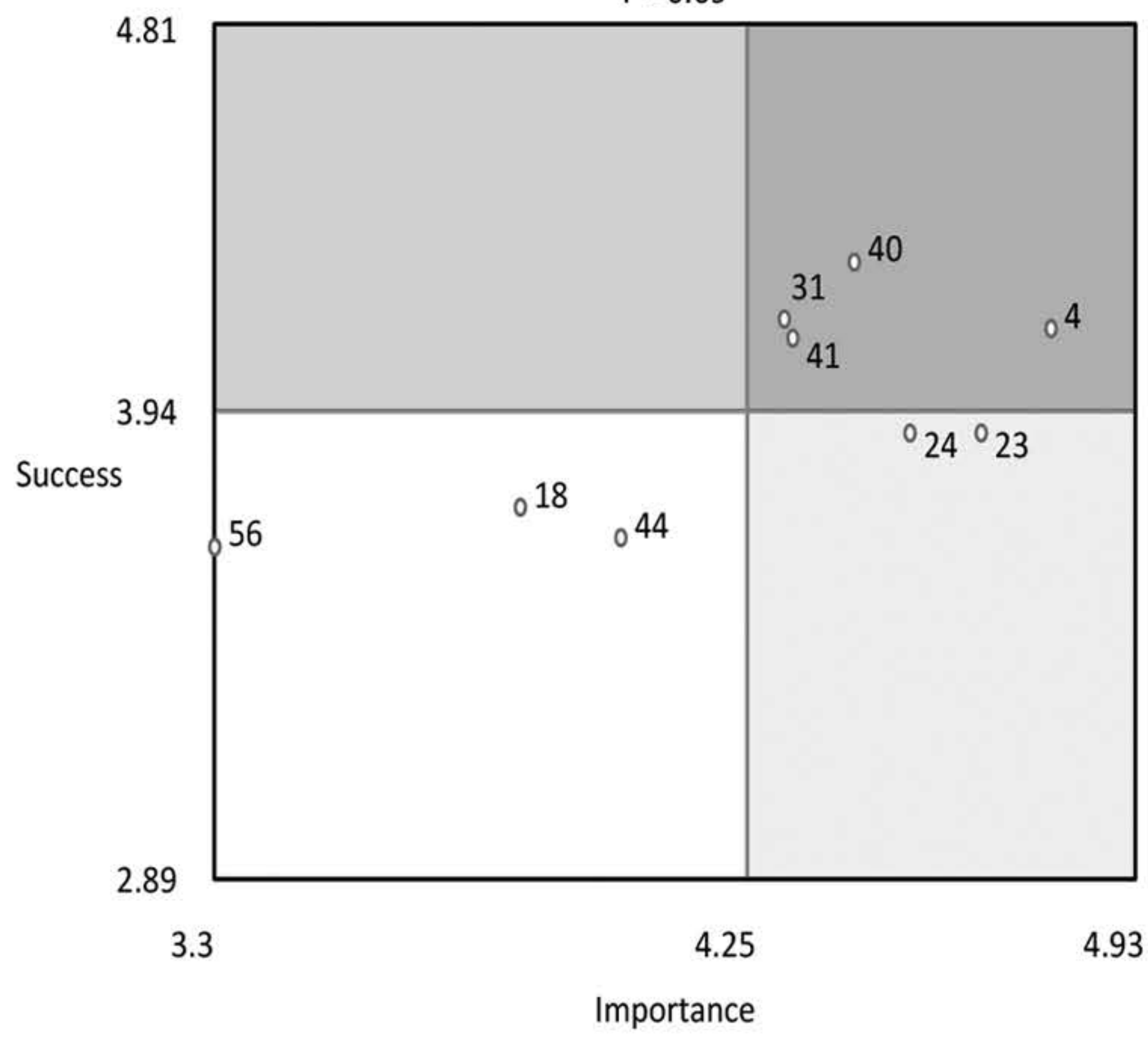






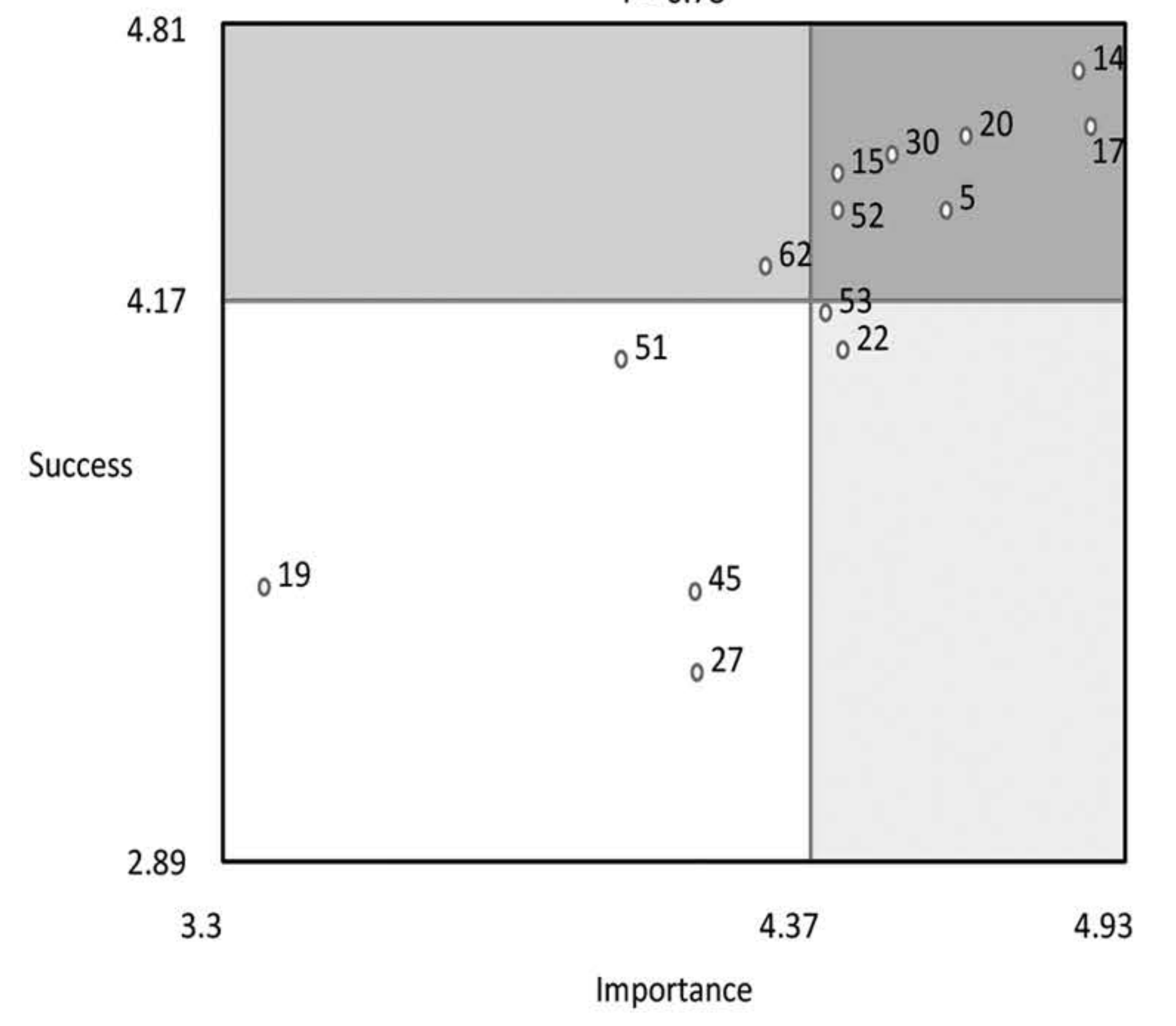
Communication & coordination

r = 0.69



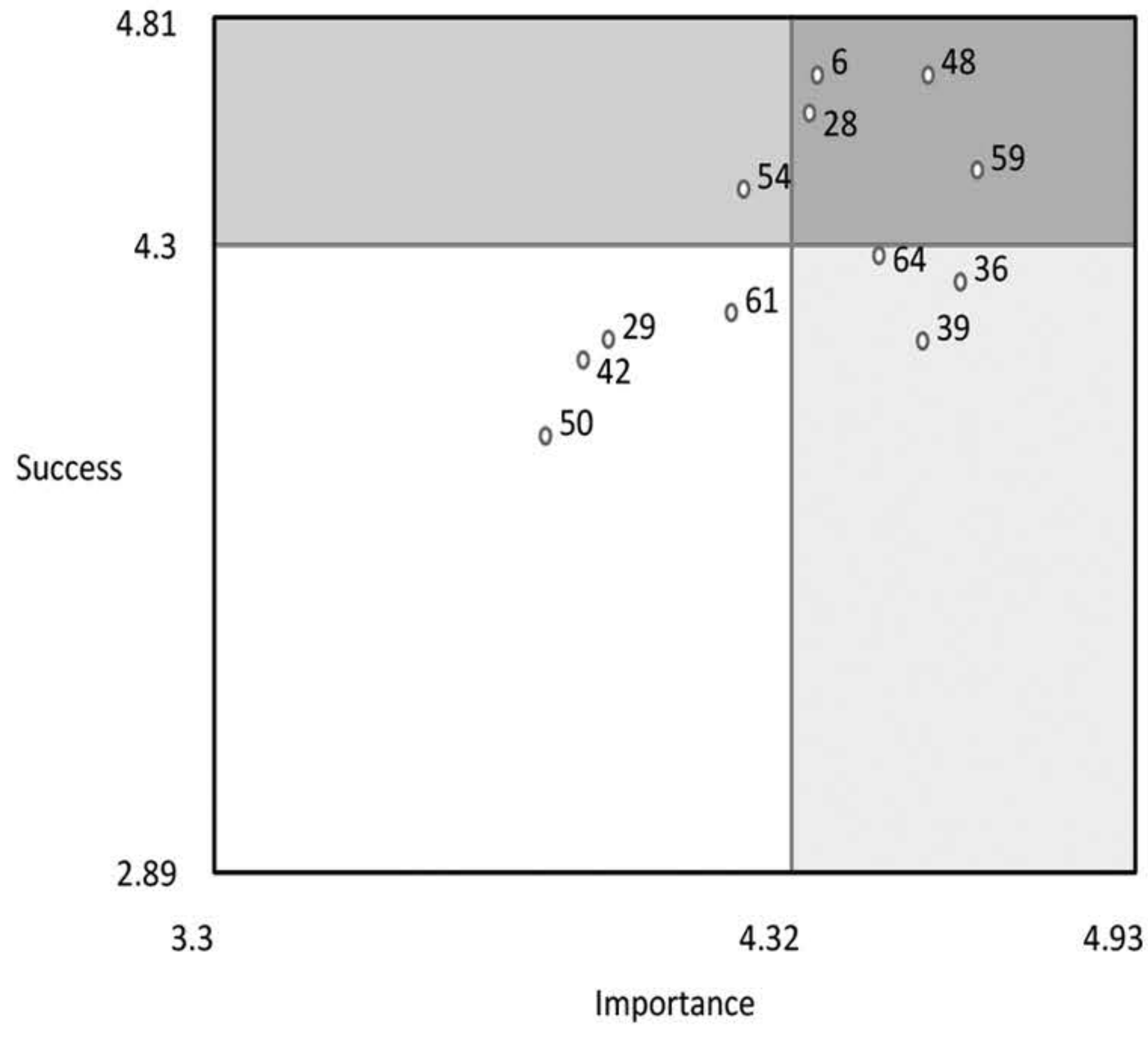
Emotional & psychological wellbeing

r = 0.78



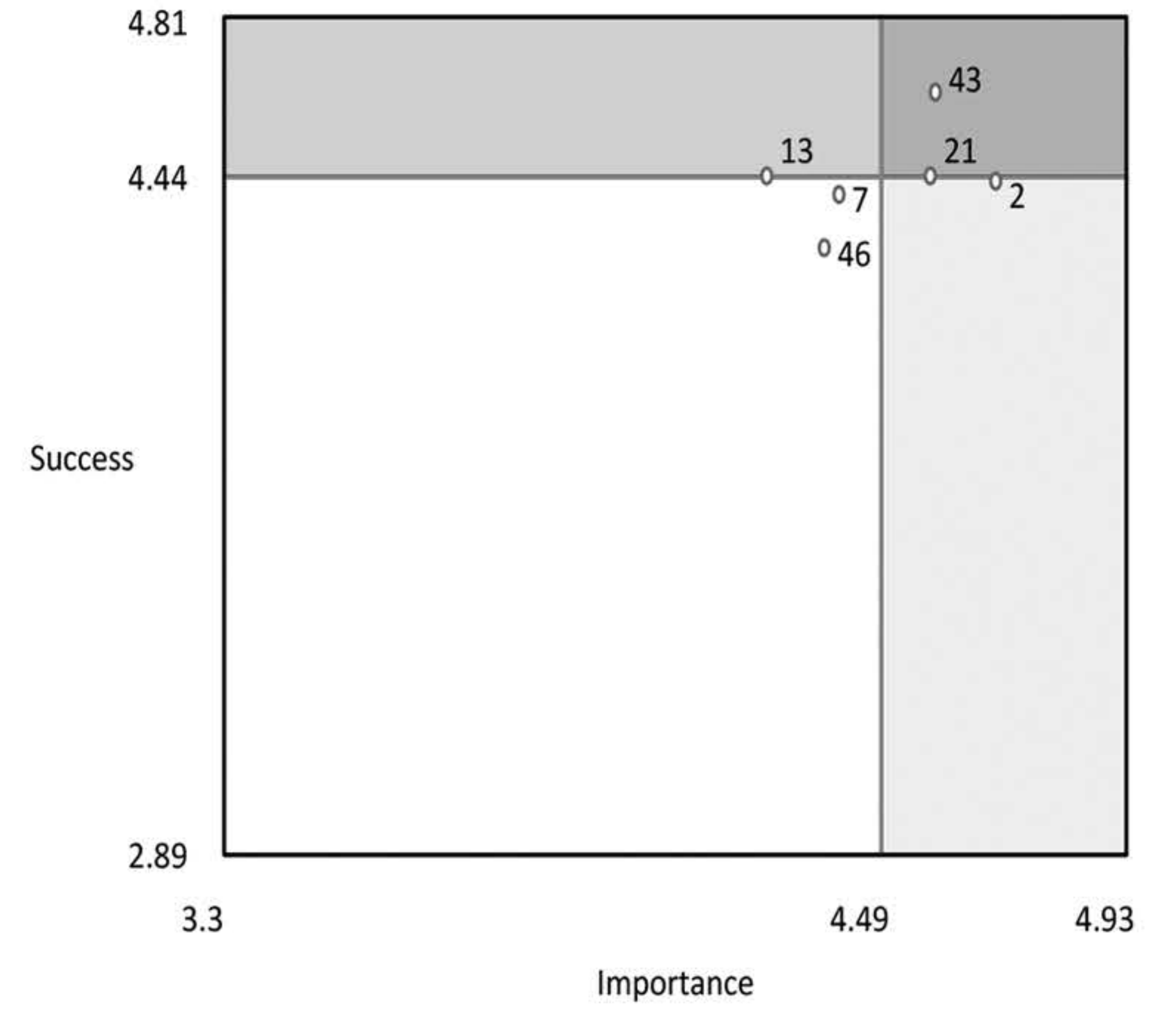
Rehabilitation environment

r = 0.57



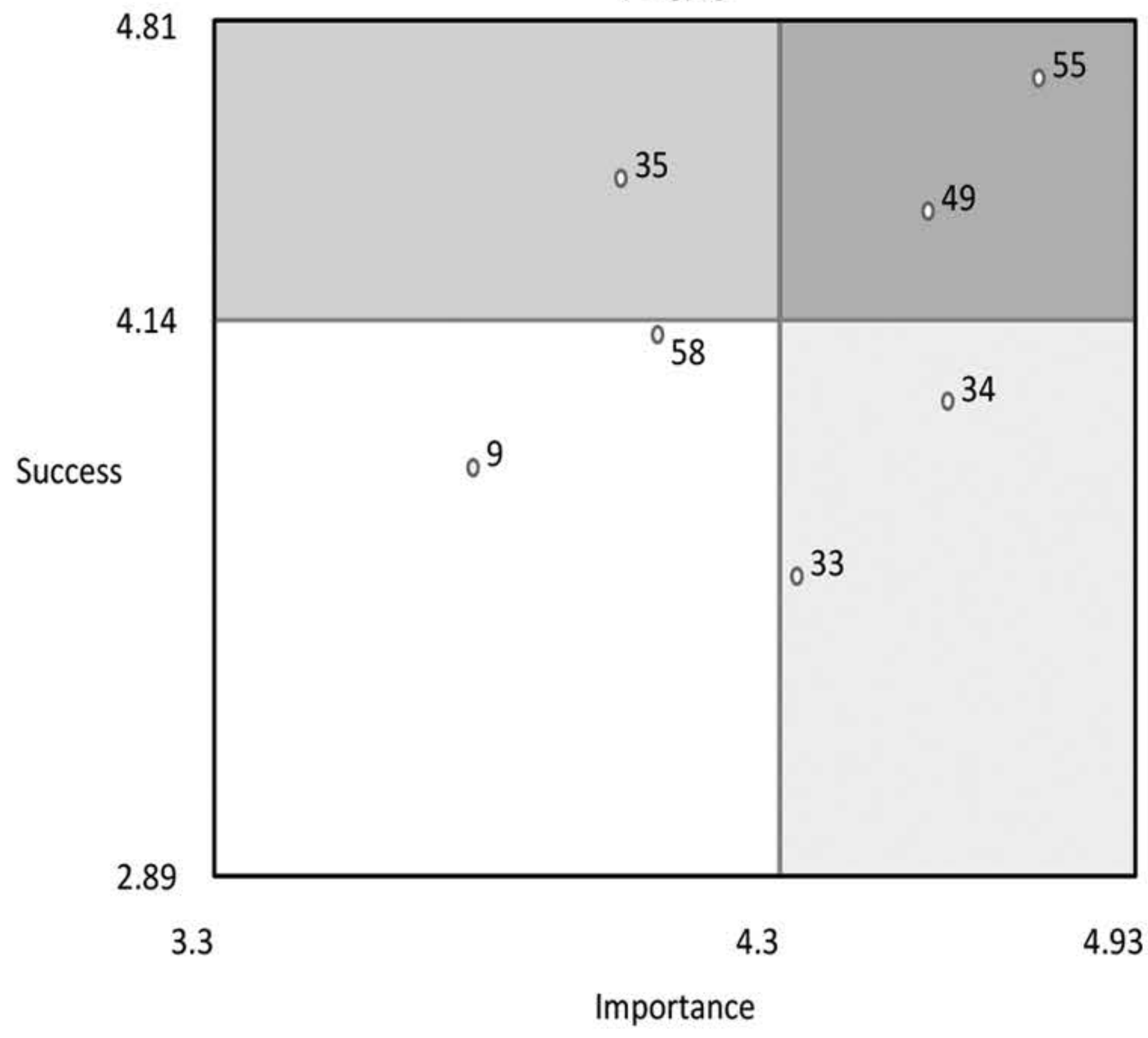
Early rehabilitation

r = 0.41



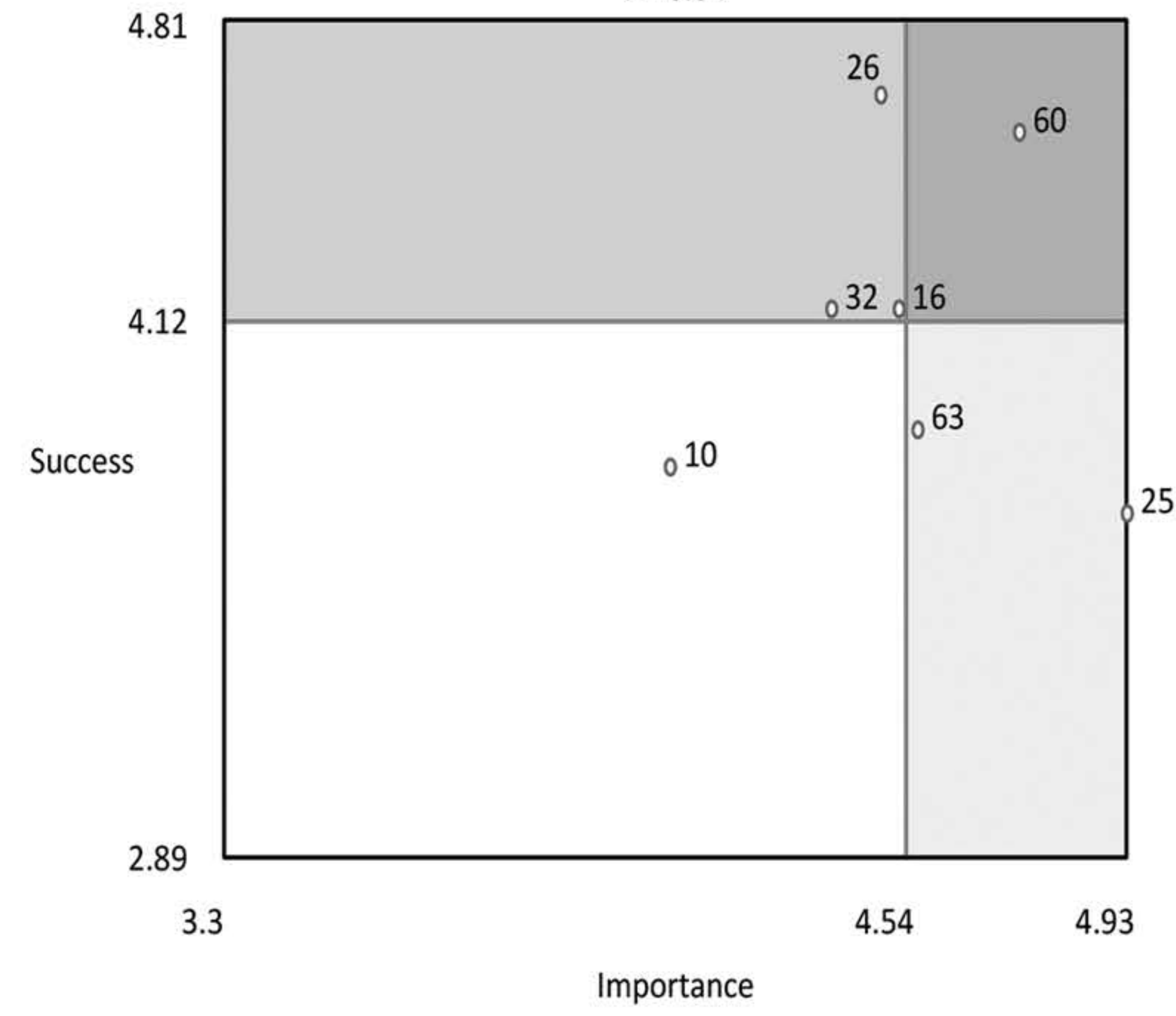
Structured therapy input

r = 0.40



Planning for home

r = 0.04



Long-term support

r = 0.77

